

**(D) Milling of Defects**

If defects are determined to be the result of the Contractor's negligence, then measurement for the re-milling or repairs will not be made. If the Engineer directs re-milling of an area that is equal to or greater than 100 ft and is not due to the Contractor's negligence, the re-milled area will be measured as provided in Subarticle 607-5(A) and paid at the contract unit price per square yard for *Milled Asphalt Pavement*, \_\_\_" *Depth* or *Milling Asphalt Pavement*, \_\_\_" to \_\_\_".

Payment will be made under:

<b>Pay Item</b>	<b>Pay Unit</b>
Milling Asphalt Pavement, ___" to ___"	Square Yard
Milling Asphalt Pavement, ___" Depth	Square Yard
Incidental Milling	Square Yard

**SECTION 609****QUALITY MANAGEMENT SYSTEM FOR ASPHALT PAVEMENTS****609-1 DESCRIPTION**

Produce and construct asphalt mixtures and pavements in accordance with a quality management system as described herein. Apply these *Standard Specifications* to all materials and work performed in accordance with Division 6. Perform all QC activities in accordance with the Department's *Hot Mix Asphalt Quality Management System (HMA/QMS) Manual* in effect on the date of contract advertisement, unless otherwise approved.

**(A) Quality Control (QC)**

Define a "quality control (QC) program" as all activities, including mix design, process control, plant and equipment calibration, sampling and testing and necessary adjustments in the process that are related to production of a pavement that meet the *Standard Specifications*. Provide and conduct a QC program in accordance with this section.

**(B) Quality Assurance (QA)**

Define a "quality assurance (QA) program" as all activities, including inspection, sampling and testing related to determining that the quality of the completed pavement conforms to specification requirements. The Department will conduct a QA program in accordance with Article 609-10.

**609-2 MIX DESIGN/JOB MIX FORMULA REQUIREMENTS**

Apply all requirements of Article 610-3.

**609-3 FIELD VERIFICATION OF MIXTURE AND JOB MIX FORMULA ADJUSTMENTS**

Conduct field verification of the mix at each plant within 30 calendar days before initial production of each mix design, when required by the Allowable Mix Adjustment Policy and when directed as deemed necessary.

Field verification testing consists of performing a minimum of one full test series on mix sampled and tested in accordance with Subarticle 609-6(B). When producing warm mix asphalt (WMA), field verification testing will include performing a tensile strength ratio (TSR) testing in accordance with AASHTO T 283 as modified by the Department. Mix obtained from Department or non-Department work may be used for this purpose provided it is sampled, tested and the test data handled in accordance with the *HMA/QMS Manual* and this article.

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Obtain the mix verification sample and split in accordance with procedures in the *HMA/QMS Manual*. Do not begin normal plant production until all field verification test results have been completed and the mix has been satisfactorily verified by the Contractor's Level II technician. Verification is satisfactory for HMA when all volumetric properties except percent maximum specific gravity at initial number of gyrations ( $\%G_{mm}@N_{ini}$ ) are within the applicable mix design criteria, and the gradation, binder content and  $\%G_{mm}@N_{ini}$  are within the individual limits for the mix type being produced. Verification is satisfactory for WMA when all volumetric properties except  $\%G_{mm}@N_{ini}$  are within the applicable mix design criteria, the TSR is equal to or above the minimum design criteria, and the gradation, binder content and  $\%G_{mm}@N_{ini}$  are within the individual limits for the mix type being produced.

In addition to the required sampling and testing for field verification, perform all preliminary inspections and plant calibrations as outlined in the *HMA/QMS Manual*. Retain records of these calibrations and mix verification tests, including superpave gyratory compactor printouts, at the QC laboratory. Furnish copies, including superpave gyratory compactor printouts, to the Engineer for review and approval within one working day after beginning production of the mix.

Conduct the initial mix verification of all new mix designs with the plant set up to produce the aggregate blend and binder content in accordance with the initially approved JMF. If the Contractor or the Engineer determines from results of QC tests conducted during mix verification that adjustments to the JMF are necessary to achieve specified mix properties, adjustments to the JMF may be made within tolerances permitted by the *Standard Specifications* for the mix type being produced, subject to approval. No reduction of asphalt binder content will be made when the average production VMA computes below the minimum specification requirement. Obtain written approval by the Engineer for all JMF adjustments.

Failure by the Contractor to fully comply with the above mix verification requirements will result in immediate production stoppage by the Engineer. Do not resume normal production until all mix verification sampling, testing, calibrations and plant inspections have been performed and approved.

### **609-4 CONTRACTOR'S QUALITY CONTROL PERSONNEL REQUIREMENTS**

Obtain all certifications in accordance with the Department's QMS Asphalt Technician Certification Program as outlined in the *HMA/QMS Manual*. Perform all sampling, testing, data analysis and data posting by or under the direct supervision of a certified QMS asphalt plant technician.

Provide a certified asphalt plant technician Level I to perform QC operations and activities at each plant site at all times during production of material for the project. A plant operator who is a certified asphalt plant technician Level I may be used to meet this requirement when daily production for each mix design is less than 100 tons provided the randomly scheduled increment sample as defined in Subarticle 609-6(B) is not within that tonnage. When performing in this capacity, the plant operator will be responsible for all QC activities that are necessary and required. Absences of the Level I technician, other than those for normal breaks and emergencies shall be pre-approved by the appropriate QA supervisor or his designated representative. Any extended absence of the technician that has not been approved will result in immediate suspension of production by the Engineer. All mix produced during this absence will be accepted in accordance with Article 105-3.

Provide and have readily available a certified asphalt plant technician Level II to supervise, coordinate and make any necessary adjustments in the mix QC process in a timely manner. The Level II technician may serve in a dual capacity and fulfill the Level I technician requirements specified above.

Provide a certified QMS roadway technician with each paving operation at all times during placement of asphalt. This person is responsible for monitoring all roadway paving operations and all QC processes and activities, to include stopping production or implementing corrective measures when warranted. Provide a certified density gauge operator when density control is being used.

Post in the QC laboratory an organizational chart, including names, telephone numbers and current certification numbers of all personnel responsible for the QC program while asphalt paving work is in progress.

#### **609-5 CONTRACTOR'S QUALITY CONTROL FIELD LABORATORY REQUIREMENTS**

For a contract with 5,000 or more total tons of asphalt mix, furnish and maintain a Department certified laboratory at the plant site. A minimum of 320 sf of floor space exclusive of toilet facilities, equipment and supplies necessary for performing Contractor QC testing is required. Provide convenient telephone and fax machine access for QMS personnel at the plant site.

For a contract with less than 5,000 total tons of asphalt mix, the QC testing may be conducted in a Department certified off-site laboratory meeting the requirements herein.

Provide testing equipment required in the test methods in Subarticle 609-6(B). Provide equipment that is properly calibrated and maintained. Allow all measuring and testing devices to be inspected to confirm both calibration and condition. If at any time the Engineer determines that the equipment is not operating properly or is not within the limits of dimensions or calibration described in the applicable test method, the Engineer may stop production until corrective action is taken. Maintain and have available a record of all calibration results at the laboratory.

#### **609-6 PLANT MIX QUALITY CONTROL**

##### **(A) General**

Include in the QC process the preliminary inspections, plant calibrations and field verification of the mix and JMF in accordance with Article 609-4. Conduct at a minimum the sampling, testing and determination of all parameters outlined in these *Standard Specifications* using test methods and minimum frequencies as specified. Perform additional sampling and testing when conditions dictate. Obtain all scheduled samples at randomly selected locations in accordance with the *HMA/QMS Manual*. Log all samples taken on forms provided by the Department. Split and retain all samples taken in accordance with the *HMA/QMS Manual*. Provide documentation as required in Subarticle 609-8. Identify any additional QC samples taken and tested on the appropriate forms. Process control test results shall not be plotted on control charts nor reported to the QA Laboratory.

Retain the untested split portion of QC aggregate and mix samples and the tested TSR specimens for 5 calendar days at the plant site, commencing the day the samples are tested. Retain the QC compacted volumetric test specimens for 5 calendar days, commencing the day the specimens are prepared. Permission for disposal may be given by QA personnel before these minimum storage periods. Retain the split portion of the Contractor's mix verification and referee mix samples until either procured by QA personnel or permission for disposal is given by QA personnel. Store all retained samples in a dry and protected location.

##### **(B) Required Sampling and Testing Frequencies**

Maintain minimum test frequencies as established in the schedule below. Complete all tests within 24 hours of the time the sample is taken, unless specified otherwise within these provisions. If the specified tests will not be completed within the required time frame, cease production at that point until such time the tests are completed.

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If the Contractor's testing frequency fails to meet the minimum frequency requirements as specified, all mix without the specified test representation will be unsatisfactory. The Engineer will evaluate if the mix may remain in place in accordance with Article 105-3.

If desired, innovative equipment or techniques not addressed by these *Standard Specifications* to produce or monitor the production of mix may be used, subject to approval.

Sample and test the completed mixture from each JMF at the following minimum frequency during mix production:

<u>Accumulative Production Increment</u>	<u>Number of Samples per Increment</u>
750 tons	1

If production is discontinued or interrupted before the accumulative production increment tonnage is completed, continue the increment on the next production day(s) until the increment tonnage is completed. Obtain a random sample within the specified increment at the location determined in accordance with the *HMA/QMS Manual*. Conduct QC testing on each random sample in accordance with Section 7.3 of the *HMA/QMS Manual*. When daily production of each mix design exceeds 100 tons and a regularly scheduled full test series on a sample from a random sample location for that JMF does not occur during that day's production, perform at least one partial test series in accordance with Section 7.3 of the *HMA/QMS Manual*. These partial test series and associated tests do not substitute for the regularly scheduled random sample for that increment.

### (C) Control Charts

Maintain standardized control charts furnished by the Department at the field laboratory. For mix incorporated into the project, record full test series data from all regularly scheduled random samples or directed samples that replace regularly scheduled random samples, on control charts the same day the test results are obtained.

In addition, partial test series results obtained due to reasons outlined in Subarticle 609-6(B) will be reported to QA personnel on the proper forms, but will not be plotted on the control charts.

Results of QA tests performed by the Engineer will be posted on the Contractor's control charts as data becomes available.

Record QC sample data on the standardized control charts in accordance with Section 7.4 of the *HMA/QMS Manual*.

Both the full test series individual test values and the moving average of the last 4 data points will be plotted on each chart. The Contractor's test data will be shown in black and the moving average in red. The Engineer's assurance data will be plotted in blue. Denote the moving average control limits with a dash green line and the individual test limits with a dash red line.

Maintain a continuous moving average with the following exceptions.

Re-establish a new moving average only when:

- (1) A change in the binder percentage, aggregate blend or  $G_{mm}$  is made on the JMF, or
- (2) When the Contractor elects to stop or is required to stop production after one or two moving average values, respectively, fall outside the moving average limits as outlined in Subarticle 609-6(E), or
- (3) If failure to stop production after 2 consecutive moving averages exceed the moving average limits occurs, but production does stop at a subsequent time, re-establish a new moving average beginning at the actual production stop point.

In addition, re-establish the moving averages for all mix properties. Moving averages will not be re-established when production stoppage occurs due to an individual test result exceeding the individual test limits or the *Standard Specifications*.

All individual test results for regularly scheduled random samples or directed samples that replace regularly scheduled samples are part of the plant QC record and shall be included in moving average calculations with the following exception. When the Contractor's testing data has been proven incorrect, use the correct data as determined by the Engineer instead of the Contractor's data to determine the appropriate pay factor in accordance with Subarticle 609-6(E). In this case, replace the data in question and any related data proven incorrect.

#### (D) Control Limits

Establish control limits for mix production in accordance with Table 609-1. Control limits for the moving average limits are based on a moving average of the last 4 data points. Apply all control limits to the applicable target source.

TABLE 609-1 CONTROL LIMITS			
Mix Control Criteria	Target Source	Moving Average Limit	Individual Limit
2.36 mm Sieve	JMF	$\pm 4.0\%$	$\pm 8.0\%$
0.075 mm Sieve	JMF	$\pm 1.5\%$	$\pm 2.5\%$
Binder Content	JMF	$\pm 0.3\%$	$\pm 0.7\%$
VTM @ $N_{des}$	JMF	$\pm 1.0\%$	$\pm 2.0\%$
VMA @ $N_{des}$	Min. Spec. Limit	Min. Spec. Limit	- 1.0%
$P_{0.075}/P_{be}$ Ratio	Max. Spec. Limit	$\pm 0.4\%$	$\pm 0.8\%$
% $G_{mm}$ @ $N_{ini}$	Max. Spec. Limit	-	+ 2.0%
TSR	Min. Spec. Limit	-	- 15%

#### (E) Corrective Actions

All required corrective actions are based upon initial test results and shall be taken immediately upon obtaining those results. If more than one corrective action or adjustment applies, give precedence to the more severe of these actions. Stopping production when required takes precedence over all other corrective actions. Document all corrective actions.

If the process adjustment improves the property in question such that the moving average after 4 additional tests is on or within the moving average limits, the Contractor may continue production.

When any of the following occur, production of a mix shall cease immediately:

- (1) An individual test result for a mix control criteria (including results for required partial test series on mix) exceeds both the individual test control limits and the applicable specification design criteria, or
- (2) Two consecutive field TSR values fail to meet the minimum specification requirement, or
- (3) Two consecutive binder content test results exceed the individual limits, or
- (4) Two consecutive moving average values for any one of the mix control criteria fall outside the moving average limits.

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Do not resume normal plant production until one of the following has occurred.

Option 1: Approval has been granted by the appropriate QA supervisor.

Option 2: The mix in question has been satisfactorily verified in accordance with Article 609-3. Normal production may resume based on the approval of the contractor's Level II technician, provided notification and the verification test results have been furnished to the QA Laboratory.

Failure to fully comply with any of the above corrective actions will result in immediate production stoppage by the Engineer. Normal production shall not resume until a complete verification process has been performed and approved by the Engineer.

Failure to stop production when required will make all mix unacceptable from the stop point tonnage to the point when Option 1 or Option 2 occurs or to the tonnage point when production is actually stopped, whichever occurs first.

In any case, remove and replace this mix with materials that comply with the *Standard Specifications*, unless otherwise approved. The Engineer will evaluate acceptance of the mix in question based on Articles 105-3 and 609-11.

Immediately notify the Engineer when any moving average value exceeds the moving average limit. If 2 consecutive moving average values for any one of the mix control criteria fall outside the moving average limits, immediately notify the Engineer of the stoppage and make adjustments. The Contractor may elect to stop production after only one moving average value falls outside the moving average limits. In either case, do not determine a new moving average until the fourth test after the elective or mandatory stop in production.

### (F) Allowable Retesting for Mix Deficiencies

The Contractor may elect to resample and retest for plant mix deficiencies when individual QC test(s) exceed one or more mix property target(s) by more than the tolerances indicated below. Perform the retesting within 10 days after initial test results are determined. Retesting shall be approved before being performed and in accordance with the *HMA/QMS Manual*. The Contractor, under the supervision of the Department's QA personnel, will perform these retests. Retests for any mix deficiency other than as listed below will not be allowed, unless otherwise permitted. Acceptance of the mix in question will be based on the retest data in accordance with Article 105-3.

The Department reserves the right to require the Contractor to resample and retest at any time or location as directed.

TABLE 609-2 RETEST LIMITS FOR MIX DEFICIENCIES	
Property	Limit
VTM	by more than $\pm 2.5\%$
VMA	by more than $\pm 2.0\%$
% Binder Content	by more than $\pm 1.0\%$
0.075 mm sieve	by more than $\pm 3.0\%$
2.36 mm sieve	exceeds both the Specification mix design limits and one or more of the above tolerances
TSR	by more than - 15% from Specification limit

## 609-7 FIELD COMPACTION QUALITY CONTROL

### (A) General

Perform QC of the compaction process in accordance with these provisions and applicable requirements of Article 610-10. The Contractor may elect to use either cored sample density procedures or density gauge procedures. Provide to the Department at the pre-construction conference the method of density QC that will be used on the project.

Establish acceptable control strips when required at locations approved by the Engineer. Construct control strips that are 300 ft in length at the paver laydown width being placed. When using core sample control, place control strips anytime placement is proceeding on limited production due to failing densities. When using density gauge control, place control strips at the minimum frequencies specified in the Department's *Density Gauge Operator's Manual*. In addition, place control strips anytime deemed necessary by the Engineer.

Conduct density sampling and testing by either method based on test sections consisting of not more than 2,000 lf or fraction thereof per day on pavement placed at the paver laydown width. Perform density sampling and testing on all pavements as outlined in Section 10.4 of the *HMA/QMS Manual* unless otherwise approved.

Perform the sampling and testing at the minimum test frequencies as specified above. If the density testing frequency fails to meet the minimum frequency as specified above, all mix without the required density test representation will be unsatisfactory. The Engineer will evaluate if the mix may remain in place in accordance with Article 105-3.

Conduct all QC density gauge testing the same day that the mix being tested is placed and compacted. Obtain all core samples no later than the beginning of the next production day, not to exceed 3 calendar days. Test QC core samples and submit test results within one working day of the time the samples are taken. If the specified density tests will not be completed within the allowable time, cease production at that point until such time the required tests are completed. Failure to provide samples may result in suspension of all project operations.

Retain QC density core samples at the plant site for 5 calendar days, commencing the day the samples are tested, or until permission for disposal is granted by the QA personnel, whichever occurs first. Retain the Department's QA comparison and verification core samples in a sealed container at the plant site until obtained by QA personnel. Store all retained density samples on a smooth, flat surface in a cool, dry and protected location.

Check core samples may be taken by the Contractor for any of the following reasons:

- (1) When core sample control is being used and a test section core sample(s) is more than 2.0% below the average of all core samples from the same lot, that core(s) samples may be checked,
- (2) When a control strip fails and a core sample(s) is more than 2.0% below the average of the control strip, that core(s) may be checked.

For each core sample that is to be checked, take 3 check samples as follows: one adjacent to the initial sample and one 10 ft in each direction, longitudinally, from the initial sample. The results of these 3 check samples will be averaged, and this average will be used instead of the initial core results in question. The initial core sample results will not be used if check samples are taken.

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Check samples shall be taken within 2 calendar days of the date of the initial sample. Only one set of check samples per sample location will be allowed. If full depth cores are necessary at these check sample locations, separation of the layer to be tested will be the responsibility of the Contractor. Take all check samples in the presence of a representative of the Engineer. In addition, a QA comparison core sample(s) may be taken adjacent to one or more of these check samples.

### (B) Pavement Samples (Cores)

When cored samples are required by either density method, obtain cores from the full layer depth of the compacted pavement at random locations determined in accordance with procedures in the *HMA/QMS Manual*. If full depth cores are taken, the Contractor is responsible for separating the layer of mix to be tested so it is not damaged. The use of a separator medium beneath the layer to be tested is prohibited.

Obtain core samples and repair the existing pavement as outlined in Section 10.4 of the *HMA/QMS Manual*.

### (C) Core Sample Density Procedures

In addition to the above requirements, perform core sample density control procedures as noted herein. When cored sample control is being used, the testing frequency will be a minimum of one random 6" core sample taken from each test section, except take a minimum of at least 3 core samples from each mix type and/or lot placed on a given day.

An initial control strip is not required at the beginning of placement of each JMF but may be performed by the Contractor for use in determining the necessary compactive effort and roller patterns. Cored sample control strips will be required if production and placement is being performed under limited production procedures due to failing densities.

### (D) Density Gauge Procedures

In addition to the requirements in Subarticle 609-7(A) perform density gauge control procedures in accordance with the *Density Gauge Operator's Manual*. This manual may be obtained through the Materials and Tests Soils Laboratory. Furnish an operator certified by the Department.

Provide a gauge calibrated within the previous 12 months by an approved calibration service. Maintain documentation of such calibration service for a 12 month period.

### (E) Limited Production Procedures

Define "resurfacing" as the first new uniform layer placed on an existing pavement. Proceed on limited production when, for the same mix type and on the same contract, one of the following conditions occur (except as noted below).

(1) Two consecutive failing lots, except on resurfacing,

(2) Three consecutive failing lots on resurfacing, or

(3) Two consecutive failing density gauge control strips.

As exceptions to the above, pavement within each construction category (New and Other), as defined in Article 610-13, and pavement placed simultaneously by multiple paving crews will be evaluated independently for limited production purposes.

Limited production is defined as being restricted to the production, placement and compaction of a sufficient quantity of mix necessary to construct only a 300 ft control strip plus 100 ft of pavement adjacent to each end of the control strip.



Remain on limited production until such time as satisfactory density results are achieved or until 2 control strips have been attempted without achieving acceptable density test results. If the Contractor fails to achieve satisfactory density after 2 control strips have been attempted, cease production of that mix type until such time as the cause of the failing density test results can be determined. As an exception, the Engineer may grant approval to produce a different mix design of the same mix type if the cause is related to mix problem(s) rather than compaction related problems.

If the Contractor does not operate by the limited production procedures when conditions as specified in Subarticles 609-7(E)(1) to 609-7(E)(3) occur, all mix produced thereafter will be unacceptable. Remove this material and replace with material that complies with the *Standard Specifications*, unless otherwise approved.

## **609-8 CONTRACTOR QUALITY CONTROL DOCUMENTATION (RECORDS)**

Document all QC activities, records of inspection, samples taken, adjustments to the mix and test results on a daily basis. Note the results of observations and records of inspection as they occur in a permanent field record. Record adjustment to mix production and test results on forms provided. Process control sample test results are for the Contractor's informational purposes only.

Make all such records available to the Engineer, upon request, at any time during project construction. Complete and maintain all QC records and forms and distribute in accordance with the *HMA/QMS Manual*. Submit data electronically using the Department's software. Failure to maintain QC records and forms as required, or to provide these records and forms to the Engineer upon request, may result in production stoppage, placement stoppage, removal from the NCDOT Certified Asphalt Laboratory List and removal from the NCDOT Certified Asphalt Plant List until the problem is resolved.

Falsification of test results, documentation of observations, records of inspection, adjustments to the process, discarding of samples and/or test results or any other deliberate misrepresentation of the facts will result in the revocation of the applicable person's QMS certification. The Engineer will determine acceptability of the mix and/or pavement represented by the falsified results or documentation. If the mix and/or pavement in question is determined to be acceptable, the Engineer may allow the mix to remain in place at no pay for the mix, asphalt binder and other mix components. If the mix or pavement represented by the falsified results is determined not to be acceptable, remove and replace with mix, that complies with the *Standard Specifications*.

## **609-9 QUALITY ASSURANCE**

The Department's QA program will be conducted by a certified QMS technician(s) and will be accomplished in the following ways:

### **(A) Plant Mix Quality Assurance**

- (1) By conducting assurance testing of split samples obtained by the Contractor at a frequency equal to or greater than 5% of the frequency required of the Contractor;
- (2) By periodically observing sampling and testing procedures performed by the Contractor;
- (3) By monitoring required control charts exhibiting test results of control parameters;
- (4) By directing the Contractor to take additional samples at any time and any location during production (instead of the next scheduled random sample for that increment);
- (5) By conducting verification sampling and testing on samples taken independently of the Contractor's QC samples; at a frequency equal to or greater than 10% of the QC sample frequency; or
- (6) By any combination of the above.

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The Engineer will periodically obtain QA and verification mix samples for testing independently of the Contractor's QC process. The Engineer will conduct assurance tests on both split QC samples taken by the Contractor and verification samples taken by the Department. These samples may be the regular QC samples, a sample selected by the Engineer from any location in the process or verification samples taken at random by the Department. The Engineer may select any or all split samples for assurance testing.

### **(B) Density Quality Assurance**

(1) By retesting randomly selected QC test sections (either cores or gauge) at a frequency equal to or greater than 5% of the frequency required of the Contractor.

(2) By periodically observing tests performed by the Contractor;

(3) By testing randomly selected comparison core samples taken adjacent to the Contractor's QC core samples (8" center-to-center) at a frequency equal to or greater than 5% of the frequency required of the Contractor; and

(4) By conducting verification sampling and testing on test sections (either core or gauge) independently of the Contractor's QC test sections at a frequency equal to or greater than 10% of the QC sample frequency.

(5) By periodically directing the recalculation of random locations for the QC core or density gauge test sites. The original QC test locations may be tested by QA personnel and evaluated as verification tests.

(6) By retesting QC core samples from control strips (either core or gauge) at a frequency of 100% of the frequency required of the Contractor;

(7) By observing the Contractor perform all standard counts of the QC gauge before usage each density testing day; or

(8) By any combination of the above.

Comparison and verification core samples will be taken in the presence of a Department technician, and either delivered directly to the appropriate QA Laboratory by a Department technician or placed in a sealed container and delivered to the Contractor's QC Laboratory for QA personnel to obtain.

Results of QA tests for plant mix and density will be provided to the Contractor within 3 working days after the sample has been obtained, except for verification TSR test results that will be provided within 7 calendar days.

**(C) Limits of Precision**

Differences between the Contractor's and the Department's split sample test results will be acceptable if within the limits of precision in Table 609-3.

<b>TABLE 609-3 LIMITS OF PRECISION FOR TEST RESULTS</b>	
<b>Mix Property</b>	<b>Limits of Precision</b>
25.0 mm sieve (Base Mix)	± 10.0%
19.0 mm sieve (Base Mix)	± 10.0%
12.5 mm sieve (Intermediate Mix)	± 6.0%
9.5 mm sieve (Surface Mix)	± 5.0%
4.75 mm sieve (Surface Mix)	± 5.0%
2.36 mm sieve (All Mixes)	± 5.0%
0.075 mm sieve (All Mixes)	± 2.0%
Asphalt Binder Content	± 0.5%
Maximum Specific Gravity ( $G_{mm}$ )	± 0.020
Bulk Specific Gravity ( $G_{mb}$ )	± 0.030
TSR	± 15.0%
QA retest of prepared QC Gyratory Compacted Volumetric Specimens	± 0.015
Retest of QC Core Sample	± 1.2% (% Compaction)
Comparison QA Core Sample	± 2.0% (% Compaction)
QA Verification Core Sample	± 2.0% (% Compaction)
Density Gauge Comparison of QC Test	± 2.0% (% Compaction)
QA Density Gauge Verification Test	± 2.0% (% Compaction)

The Engineer will immediately investigate the reason for differences if any of the following occur: QA test results of QC split sample does not meet above limits of precision, QA test results of QC split sample does not meet the individual test control limits or the specification requirements or QA verification sample test results exceed the allowable retesting tolerances.

If the potential for a pavement failure exist, the Engineer may suspend production, wholly or in part, in accordance with Article 108-7 while the investigation is in progress. The Engineer's investigation may include, but not be limited to joint testing of any remaining split samples, review and observation of the QC technician's sampling and testing procedures, evaluation and calibration of QC testing equipment, and comparison testing of other retained QC samples and additional density core samples.

If additional mix samples or core samples are necessary to resolve the difference, these samples will be taken as directed and tested jointly by the Contractor's QC personnel and the Department's QA personnel. If reasons for the difference cannot be determined, payment for the mix in question will be determined in accordance with Article 105-3. If the reason for the difference is determined to be an error or other discrepancy in the QC test results, the applicable QA test results or verification test results will be used to determine compliance with the applicable mix or density specification requirements.

The Engineer will periodically witness the sampling and testing being performed by the Contractor. If the Engineer observes that the sampling and QC tests are not being performed in accordance with the applicable test procedures, the Engineer may stop production until corrective action is taken. The Engineer will promptly notify the Contractor of observed deficiencies, both verbally and in writing. The Engineer will document all witnessed samples and tests.

## Section 610

### 609-10 ACCEPTANCE

Final acceptance of the asphalt pavement will be made by the Department in accordance with the following:

#### (A) Mix Acceptance

The Engineer will base final acceptance of the mix on the results of random testing made on split samples during the QA process and validation of the Contractor's QC process as outlined in Articles 609-6 and 609-7.

#### (B) Density Acceptance

The Department will evaluate the asphalt pavement for density compliance after the asphalt mix has been placed and compacted using the Contractor's QC test results, the Department's QA test results and by observation of the Contractor's density QC process as outlined in Articles 609-7 and 610-14.

### 609-11 MEASUREMENT AND PAYMENT

Any mix produced that is not verified may be assessed a price reduction at the Engineer's discretion in addition to any reduction in pay due to mix or density deficiencies.

Produce and construct all asphalt mixtures and pavements in accordance with these *Standard Specifications*. There will be no direct payment for work covered by this Specification. Payment at the contract unit prices for the various asphalt items will be full compensation for all work covered by these specifications.

If the mix or pavement represented by the falsified results is removed and replaced, payment will be made for the actual quantities of materials required to replace the falsified quantities, not to exceed the original amounts.

## SECTION 610

### ASPHALT CONCRETE PLANT MIX PAVEMENTS

#### 610-1 DESCRIPTION

Perform the work covered by this section including, but not limited to, the construction of one or more courses of asphalt mixture placed on a prepared surface in accordance with these Specifications and in reasonably close conformity with the lines, grades, thickness and typical sections shown on the plans. This work includes producing, weighing, transporting, placing and compacting the plant mix; furnishing aggregate, asphalt binder, anti-strip additive and all other materials for the plant mix; furnishing and applying tack coat as specified; furnishing scales; maintaining the course until final acceptance of the project; making any repairs or corrections to the course that may become necessary; providing and conducting QC as specified in Section 609; and surface testing of the completed pavement. The design requirements for the various mix types are given in Section 610 for Superpave mix types, Section 650 for OGAF, Section 652 for PADC and Section 661 for UTBWC.

Provide and conduct the QC and required testing for acceptance of the asphalt mixture in accordance with Section 609.

Define "warm mix asphalt (WMA)" as additives or processes that allow a reduction in the temperature at which asphalt mixtures are produced and placed. WMA is allowed for use at the Contractor's option when shown in the contract or as approved by the Engineer.

#### 610-2 MATERIALS

Refer to Division 10.

#### Item

Anti-Strip Additives

Asphalt Binder, Performance Grade

#### Section

1012-1(G)

1020-2